

APPENDIX A

Clean Version of Specification Pages 4, 5, 6, and 7

In another embodiment, there is a combination of the ball joint described just above, and a socket to provide a ball joint system. The socket comprises a cylindrical housing having a wall with an internal surface wherein the internal surface is threaded to receive the housing in it and the socket has a means of attachment for attachment near a terminal end of a carrier for the ball joint system.

Finally, there is an additional embodiment of this invention that is an automotive suspension system incorporating the ball joint systems described just above.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a full view of a ball joint system of this invention that is fully assembled.

Figure 2 is a full view of the ball and the elongated shaft of this invention.

Figure 3 is a full view of the housing of this invention

Figure 4 is a full top view of the housing of this invention without the retaining member in place

Figure 5 is a full top view of the housing of this invention with the retaining member in place.

Figure 6 is a full cross-sectional view of the housing of Figure 3 through the lines 100-100 of Figure 3 and also showing the ball therein.

Figure 7 is a full view of the retaining member of this invention.

Figure 8 is a full cross-sectional view of the retaining member of Figure 7 through the lines 200-200 of Figure 7, and includes the ball and shaft therewithin.

Figure 9 is a full view of a fully assembled ball joint system of this invention and including the socket.

Figure 10 is a full top view of the socket of Figure 9.

Figure 11 is a schematic drawing of one type of automotive suspension system showing the use of the ball joint systems of this invention.

Figure 12 is a full view in perspective of a portion of the suspension system of Figure 11, wherein there is shown a wishbone support arm containing a ball joint system of this invention.

Figure 13 is a full top view of the wishbone support arm of Figure 12.

DETAILED DESCRIPTION OF THE INVENTION

Turning now to the Figures, and with reference to Figure 1, which is a full view of a ball joint system 27 of this invention that is fully assembled. There is shown as the components thereof, an elongated shaft 2, and the ball 3 (only a portion of the bottom of the ball is shown therein), the housing 4, with external threads 5, a retaining member 6, and a fastening means 7, which is a set screw 8 set into a threaded (not shown) opening 9, in an upper flange 10 of the housing 4.

It should be noted that the elongated shaft 2 is threaded at its lower end 11, and that there is an opening 12 though the threaded portion 13 of the elongated shaft 2 to accommodate a cotter pin (not shown), or the like, to retain a nut 31 (see Figure 9), which in turn retains the elongated shaft 2 in a portion of a suspension system that is discussed below. It is contemplated within the scope of this invention to provide ball joints wherein the shafts 2 are provided in various lengths. The reason for the various lengths is that in racing, it is desirable to alter the suspension angles and positions to affect handling, i.e., roll centers, camber gain and other related geometry. Having ball joints with variable length shafts gives the users an option for altering the suspension geometry of the automobile using the ball joints. Currently, racers will change or alter the spindles to make the same geometry changes, and this provides an increased cost, as the spindles are about 6 to 7 times more expensive than the ball joints of this invention.

Figure 2 is a full view of the combination 1 of the ball 3 and the elongated shaft 2 without the remainder of the components being shown, for clarification. Thus there is shown the ball 3, the elongated shaft 2, a truncated flat surface 14 at the topmost point of the ball 3, and the threaded portion 13 at the lower end 11, along with the opening 12. What is meant by "longitudinal axis running through said upper end and said lower end" is shown by the line 300-300 in Figure 2, which indicates the principal axis that the ball 3 would revolve around, it being understood that the ball will tilt from this axis within the housing 4 to provide flexibility in the ability of the ball 3 to coordinate with the suspension systems noted *infra*, and the degree of movement within the housing 4 is limited only by the contact of the elongated shaft 2 with the lower edge 15 of the housing 4, and/or the connection that the elongated shaft 2 has with the suspension system and the wheel 33 shown in Figure 11.

It should be noted that the preferred combination 1 of ball 3 and elongated shaft 2 is that in which the two are joined as a unitary component. This combination is manufactured from hardened steel or the like to endure the wear that usually accompanies such devices. The truncated flat surface 14 is provided so that there is a space or void 25 (see Figure 8) formed above the ball 3 when in the housing 4. The space 25 is intended to contain lubricant, namely, a thickened oil or grease which is not shown in this Figure, but which can be any common lubricant known in the art. Filling the void 25 above the truncated surface 14 allows for pressure to be applied to the ball 3, while in the housing 4, and is employed to help seat the ball in the seat 18 (see Figure 4) provided at the lower end of the housing 4. The pressure created by lubricants inserted into the void 25 is also a means to help adjust the ball 3 in the housing 4 to accommodate for any wear on the ball 3. As far as is known by the inventors herein, this means of accommodating for wear on the ball 3 is not known independently of mechanical means, or as a sole means for providing such pressure.

The housing 4, which houses and seats the ball 3 is shown in Figure 3. With reference to this Figure, there is shown the threaded exterior surface 5, which inserts into the socket 16, that is described *infra*, the lower edge 15, which in this Figure is beveled to fit into the bottom of the socket 16, the flange 10 which is configured such that it can be used to turn the housing 4 into the socket 16, and in this Figure, the flange 10 is shown as a hexagon configuration also any convenient configuration that allows the turning of the housing 4 is contemplated within the scope of this invention. In the side surface of the flange 10, there is shown a fastening means 7 for the housing 4, to retain the retaining member 6 in the housing 4, which fastening means 7 is comprised of a simple set screw combination wherein there is shown the threaded opening 9, into which a set screw 8 is inserted and turned down to complete the fastening. The type of fastening means 7 is not critical in this invention, and any fastening means which will secure the retaining member 6 in the housing 4 and which is fairly simple to use, is acceptable.

With reference to Figure 4, which is a top view of the housing 4, there is shown the flange 10, the fastening means opening 9, in phantom, the internal threads 17 for accommodating the external threads 18 of the retaining member 6, and the seat 18 for the ball 3, which is located near the bottom edge 15 of the housing 4.

Further, with reference to Figure 5, which is a top view of the housing 4, wherein there is shown the flange 10, therein is situated in the housing 4, a retaining member 6, wherein there is shown the top 19 of the retaining member 6, a concavity 20 in the top 19, and detachably fixed in the concavity 20, a grease zerk fitting 21. Generally, such grease zerk fittings 21 are threaded and screwed into a threaded opening and that is contemplated within the scope of this invention as well as any convenient means of inserting and fastening the grease zerk fitting 21. Also shown in this Figure are indentions 22, which are indented in the wall of the concavity 20, which indentions 22 are useful for applying a wrench or some other viable means to turn the retaining member 6 in and out of the housing 4. The indentions 22 are not critical to this invention and can be optionally included in the retaining member 6, and can be configured other than as an indentation as shown.

Reference should also be made to Figure 6, which is a cross-sectional view of the housing 4, taken through line 100-100 of Figure 3, wherein there is shown the flange 10, the opening 9, the set screw 8 tail end, the external threads 5, and the internal threads 17, which accommodate the external threads 24 of the retaining member 6 (see also Figures 7 and 8).

With further reference to the retaining member 6, reference should be made to Figure 7, which is a full view of the retaining member 6, showing the top 19 and the external threads 24. Figure 8 is a full cross-sectional view of the retaining member 6 through line 200-200 of Figure 7, wherein, there is shown the top 19, the external threads 24, the concavity 20, and the grease fitting 21. Also shown is the duct 23, which allows lubricant applied to the grease fitting 21 to be carried to the void 25 (see Figure 8), wherein the ball 3 is shown and wherein the majority of the lubricant resides. Also shown in Figure 6 are the shallow channels 26 which in the prior art ball joints are typically placed into the ball 3, but which in this invention are placed in the interior of the housing 4. The reason for this placement of the shallow channels 26 is primarily cost, as placing the shallow channels 26 in the housing 4, means that expensive machining does not have to be done in the ball 3, which is the part that is replaced more often.